

CLAIMS

What is claimed is:

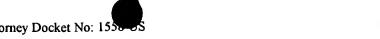
- 1 1. A method for measuring low-power components of non-coherently sampled test 2 signals that include at least one tone each having a known frequency, comprising:
- 3 executing a DFT on the sampled test signal;
- 4 modeling spectral components of the at least one tone, including effects of
- 5 leakage induced by the at least one tone; and
- adjusting the DFT by an amount prescribed by the modeled spectral components to provide a substantially leakage-free measure of low-power components of the test
- 8 signal.
- 1 2. A method as recited in claim 1, wherein the step of modeling includes modeling at least one spectral component of the at least one tone.
- 1 3. A method as recited in claim 2, wherein the step of modeling accounts for the
- 2 known frequency of each expected tone and a plurality of known sampling parameters
- 3 related to sampling the test signal.
- 1 4. A method as recited in claim 3, wherein the step of modeling includes applying
- 2 actual values from the DFT to determine the amplitude each of expected tone in the
- 3 modeled spectrum.
- 1 5. A method as recited in claim 4, wherein the actual values from the DFT
- 2 correspond to bins of the DFT containing each expected tone.
- 1 6. A method as recited in claim 3, wherein plurality of known sampling parameters
- 2 includes the number of cycles M_i of each expected tone of the test signal within the
- 3 sample window, the number of samples N within the sample window, and the sampling
- 4 rate F_s.



- 1 7. A method as recited in claim 6, wherein the modeled spectral components have
- 2 substantially the form—

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$$X_W[k] = \sum_{i=1}^{p} [A_i/2 (W(k/N - (1+\alpha_i)M_i/N))]$$

- $+ A_i*/2 (W(k/N (1-(1+\alpha_i)M_i/N)))],$
- 5 wherein
- 6 k is any bin of the predicted DFT,
- 7 A_i is the complex amplitude of the component in bin k,
- p is the number of test tones in the test signal,
- 9 α_i is a ratio error in the sampling of the ith test tone, and
- 10 $W(f) = e^{(-j2\pi f(N-1)/2)} \sin(\pi f N) / \sin(\pi f).$
- 1 8. A method as recited in claim 7, wherein α represents an ideal, coherent sampling
- rate F_s divided by the actual sampling rate F_s' , minus one, or $\alpha = F_s/F_s' 1$.
- 1 9. A method as recited in claim 1, wherein the low-power components comprise
- 2 noise and distortion in the test signal.
- 1 10. A method as recited in claim 1, wherein the step of adjusting the DFT includes
- 2 subtracting a modeled spectral component from the value of each corresponding bin of
- 3 the DFT.
- 1 11. An apparatus for measuring low-power components of non-coherently sampled
- 2 test signals including at least one tone each having a known frequency, comprising:
- means for executing a DFT of a sampled test signal;
- 4 means for modeling spectral components of the at least one tone, including effects
- 5 of leakage induced by the at least one tone; and
- 6 means for adjusting the DFT by an amount prescribed by the modeled spectral
- 7 components to generate a substantially leakage-free measure of noise and distortion in the
- 8 test signal.



- An apparatus as recited in claim 11, wherein plurality of known parameters
- include the number of cycles M_i of each test tone of the test signal within the sample 2
- window, the number of samples N within the sample window, and the sampling rate F_s. 3
- 13. An apparatus as recited in claim 12, wherein the modeled spectral components 1
- 2 have substantially the form—

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$$X_W[k] = \sum_{i=1}^{p} [A_i/2 (W(k/N - (1+\alpha_i)M_i/N))]$$

- $+ A_i*/2 (W(k/N (1-(1+\alpha_i)M_i/N)))],$ 4
- 5 wherein

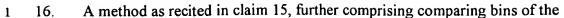
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- k is any bin of the predicted DFT, 6
- A_i is the complex amplitude of the component in bin k, 7
- p is the number of tones in the test signal, 8
- α_i is a ratio error in the sampling of the ith test tone, and
- $W(f) = e^{(-j2\pi f(N-1)/2)} \sin(\pi f N) / \sin(\pi f).$ 10
- 14. An apparatus as recited in claim 13, wherein α represents the ideal, coherent 1
- sampling rate F_s divided by the actual sampling rate F_s' , minus one, or $\alpha = F_s/F_s' 1$. 2
- **№15**. A method for testing the a non-coherently sampled test signal including at least 1
- one tone each having a known frequency, comprising: 2
- 3 applying a stimulus signal to an input of a device under test;
- sampling a test signal from an output of the device under test; 4
- 5 executing a DFT on the sampled test signal;
- 6 modeling the spectrum of the at least one tone, including effects of leakage
- 7 induced by the at least one tone; and
- 8 adjusting the DFT by an amount prescribed by the modeled spectrum to generate
- a substantially leakage-free DFT of the test signal. 9

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- 2 adjusted DFT with one or more threshold levels to determine whether the device under
- 3 test passes or fails.
- 1 17. A method as recited in claim 16, further comprising testing a plurality of devices.
- 1 \(^18\). An apparatus for testing a non-coherently sampled test signal including at least one tone each having a known frequency, comprising:
- a stimulus circuit for applying a stimulus signal to an input of a device under test;
- a sampling circuit for sampling a test signal from an output of the device under
- 5 test;
- 6 means for executing a DFT on the sampled test signal;
- means for modeling the spectrum of the at least one tone, including effects of leakage induced by the at least one tone; and
 - means for adjusting the DFT by an amount prescribed by the modeled spectrum to generate a substantially leakage-free DFT of the test signal.
- 1 19. An apparatus as recited in claim 18, further comprising means for comparing bins
- 2 of the adjusted DFT with one or more threshold levels to determine whether the device
- 3 under test passes or fails.
- 1 20. An apparatus as recited in claim 19, further comprising means for testing a
- 2 plurality of devices.